S
662.65
N7aew
1988
C-1

Kemmis, Daniel
Assessment of
expanding wood
pellet use in
Mineral, Missoula,
and Ravalli
Counties
6188

RENEWABLE ENERGY REPORT LIBRARY

ASSESSMENT OF EXPANDING WOOD PELLET USE

in

MINERAL , MISSOULA , AND RAVALLI COUNTIES

STATE DOCUMENTS COLLECTION
[illegible]
MONTANA STATE LIBRARY
1515 E. 6th AVE.
HELENA, MONTANA 59620

Prepared for

MONTANA DEPARTMENT of NATURAL RESOURCES and CONSERVATION

PLEASE RETURN

MONTANA STATE LIBRARY
S 662.65 N7aew 1968 c.1 Kammis
Assesament of expanding wood pellet uae
3 0864 00060566 0

MONTANA STATE LIBRARY
1515 E. 6th AVE.
HELENA, MONTANA 59620

ASSESSMENT OF EXPANDING WOOD PELLET USE in MINERAL, MISSOULA, AND RAVALLI COUNTIES

Submitted as the Final Report of the
Bitter Root RC&D Grant No. RAE-86-1069

by

Daniel Kemmis
545 Cleveland
Missoula, Montana 59801
549-3135

on behalf of

Bitter Root Resource Conservation and Development Area, Inc.
223 South Second
Hamilton, Montana 59840
363-5011

Funded by the
Montana Department of Natural Resources and Conservation

Submitted
February 26, 1988

A study to explore the possibility of encouraging conversion
to wood pellets to replace fossil fuel with
a Montana biomass resource.

Available from
Montana State Library
1515 East Sixth Avenue
Justice and State Library Building
Helena, Montana 59620

This project was made possible in part with government support under contract DE-FG79-82BP35776 awarded by the Bonneville Power Administration (BPA) and contract RAE-86-1069 awarded by the Montana Department of Natural Resources and Conservation (DNRC). Such support does not constitute an endorsement by BPA or DNRC of the views expressed in this work and the user agrees to hold BPA and DNRC harmless against any direct or consequential damages claimed by the user or their parties arising from or related to use or interpretations of this program.

EXECUTIVE SUMMARY

This study was designed to explore conversion to wood pellets to replace fossil fuel with a Montana biomass resource. The study also sought to examine the possibilities of building demand for wood pellets through special financing programs to leverage the construction and operation of a new wood pellet facility. A longer-term objective was to assist conversion to pellet use in communities like Missoula and Helena, where the proliferation of wood stoves has made air pollution a major problem. Wood pellets are a processed wood fuel. They have a higher combustion efficiency than stick wood burning, and thus emit fewer pollutants. Laboratory tests have proven that pellets produce less pollution. Expanded wood pellet consumption and production would also create jobs in the currently depressed timber and wood products sector of the Montana economy.

Study methods included analysis of existing surveys, and interviews of pellet suppliers and institutional managers to determine levels of public awareness about pellets, as well as changes in public attitudes. We employed a national computer search for a general literature survey of topics related to the study, and more specifically for an analysis of innovative financing and marketing strategies. We inventoried currently generated mill residues to determine how much would be available to the pellet manufacturing industry. We also studied production costs, both by interviewing pellet plant managers and by consulting resources available within the Department of Natural Resources and Conservation. Using existing surveys and wood pellet sales, we analyzed and projected future wood pellet consumption in the greater Missoula area. We undertook the study because we thought that the Missoula Valley, with its air pollution problems, should be a potentially expanding market for wood pellets. The study has strongly confirmed this perception. The market is expanding steadily and a number of factors point toward continued expansion. The major limitations upon that market growth are consumer uncertainty about the source of supply, and economic considerations, especially about the high initial capital outlay for equipment. A program that would address these concerns would expand substantially the growth in a market that is already expanding very quickly.

On the supply side, the picture is complicated by the fact that other wood products industries in the Missoula area consume a large percentage of the locally available feedstock for a pellet plant. This means either that feedstock would have to be obtained from as far away as Flathead and Lincoln Counties, or that small sawmills closer to Missoula, which do not ship their waste to the pulp or particleboard plants, would have to be induced to participate in a pellet-making operation. Again, a cooperative approach modeled on other supplier cooperatives should be further explored.

Our major recommendation for additional work is that research be conducted into the various possibilities of combining innovative financing and marketing strategies with different cooperative approaches to wood pellet production and distribution, as well as the sale of pellet-burning equipment. We recommend that local governments or other appropriate entities sponsor discussions, involving pellet suppliers, pellet stove manufacturers, small sawmill owners, wood burning consumer groups, and existing and potential pellet producers, to consider ways of following up on the recommendations of this study.

TABLE OF CONTENTS

INTRODUCTION 1

1. Description of project's history & reasons for conducting study 1
2. Summary of study results 2

STUDY METHODOLOGY 5

1. Goals and objectives of the study 5
2. Methodology and techniques used to conduct study 6

RESULTS AND DISCUSSION 9

1. Current wood pellet market 9
2. Results of market assessment 10
3. Summary of market assessment regarding potential growth of wood pellet demand 15
4. Potential innovative marketing and financing strategies 15
5. Feasibility of increasing pellet production 18

RESOURCE ASSESSMENT 19

1. Biomass resource availability in the area 19
2. Other major factors necessary to development of wood pellet plant 20
3. Summary of resources available 21

ECONOMIC ANALYSIS 22

1. General plant design and layout 22
2. General assumptions, level of production capacity, and economic parameters used in performing economic assessment 24
3. Summary of results of economic analysis 25

GRANT ADMINISTRATION 26

1. Work schedule 26
2. Budget 27
3. Technology transfer activities summary 27

RESULTS AND CONCLUSIONS 29

1. Summary of major findings and recommendations 29

2. Additional work needed to encourage growth in wood pellet market 31

INTRODUCTION

1. Description of project's history & reasons for conducting study.

This project grew out of a series of events and decisions in each of the three counties served by the Bitter Root Resource Conservation and Development Area, Incorporated (RC&D). In 1985, The RC&D assisted the Darby pellet plant (Bitter Root Timber Products) with a loan application to the Energy Division of DNRC, to enable the plant's owners to expand and improve the production of pellets. That loan was eventually approved, and the improvements have now been made. Later in 1985, during a series of forums conducted by the RC&D on various economic development issues in Missoula County, the subject of wood burning was discussed. The owners of the Darby pellet plant participated in that forum, and there was considerable interest in the possibility of expanding the use of pellets in Missoula, as a way of improving the air quality in that valley. (Standard emission tests have identified that wood pellets, burned in wood pellet appliances, produce less particulate and other pollutants.) In 1986, in one of a series of similar forums in Mineral County, pellets were again a central focus of discussion. The Mineral County commissioners had converted the "Old Hospital" (now the library and Senior Citizens' Center) from coal to pellets, and they were interested in the possibility of further conversions within the county, perhaps leading eventually to the establishment of a pellet production plant in Mineral County. As in Missoula County, the Mineral County Economic Development Corporation invited the Darby producers to participate in a forum, and then invited Howard Haines of the Energy Division to a later forum. At that meeting, Mr. Haines mentioned a new round of grants for research projects, including feasibility studies; the RC&D asked if it might be possible to apply for a grant to explore the feasibility of expanded pellet consumption and production within the 3-county area. Mr. Haines replied that such a study would probably only be funded if there were some innovative aspects to it that would not normally be undertaken by a private producer.

The RC&D then conducted additional discussions with both the Mineral and the Missoula County commissioners. Based upon those discussions, it was decided was to concentrate most heavily upon the possibility of expanding the demand for wood pellets in Missoula, as a way of reducing air pollution. In particular, we proposed to study innovative financing and marketing mechanisms that might enable residential wood burners to convert to pellets. Since such mechanisms would not normally be within the competence or capacity of private pellet producers, this investigation appeared to be a legitimate and necessary use of DNRC study funds. It also began to become clear that expanded pellet consumption or production in this region would require a number of other innovative departures, including cooperation among political jurisdictions, among wood harvesters, and perhaps among small sawmill operators. These possibilities seemed appropriate for study under public auspices. The grant proposal was submitted in April 1986, and was approved in June of that year.

2. Summary of study results.

We undertook the study because we thought that the Missoula Valley, with its air pollution problems, should be a potentially expanding market for wood pellets. The study has strongly confirmed this perception. The market is expanding steadily and a number of factors point toward continued expansion. The major limitations upon that market growth are consumer uncertainty about the source of supply, and economic considerations, especially about the high initial capital outlay for pellet-burning appliances or conversion. A program that would address these concerns would expand substantially the growth in a market that is already expanding very quickly.

With the institutional sector, the main emphasis has to be on those institutions not readily served by natural gas. Within those areas, the interest in pellets is high, and the attitude is generally positive. But concern about reliability of supply and about large up-front capital outlays are major deterrents to conversion to wood pellets. With both classes of consumers, the possibility of a consumer cooperative should be explored, with provisions for a revolving loan fund to soften the impact of the capital expenditure.

On the supply side, the picture is complicated by the fact that other wood products industries in the Missoula area consume a large percentage of what would otherwise be locally available feedstock for a pellet plant. This means either that feedstock would have to be obtained from as far away as Flathead and Lincoln Counties, or that small sawmills closer to Missoula, which do not ship their waste to the pulp or particleboard plants, would have to be induced to participate in a pellet-making operation. A cooperative approach (modeled on other supplier cooperatives) should be further explored.

Our major recommendation for additional work is that research be conducted into the various possibilities of combining innovative financing and marketing strategies with different cooperative approaches to wood pellet production and distribution, as well as the sale of pellet-burning equipment. We recommend that local governments or other appropriate entities sponsor discussions, involving pellet suppliers, pellet stove manufacturers, small sawmill owners, wood burning consumer groups, and existing and potential pellet producers, to consider ways of following up on the recommendations of this study.

STUDY METHODOLOGY

1. Goals and objectives of the study.

This research project has addressed itself to a number of goals and objectives. The grantee, the Bitter Root Resource Conservation and Development Area, Inc. has, as its name implies, a longstanding interest in both resource conservation and development. One of our chief objectives was to explore the possibility of encouraging conversion to wood pellets as a means of replacing fossil fuel use with the harvest and use of a Montana biomass resource.

At the outset, we identified the two major problems inhibiting the growth of wood pellet technology as the "chicken-and-egg" relationship between pellet production and pellet markets, and the lack of consumer familiarity with the technology. We designed the study to address the first problem by developing a strategy for more closely linking market and production capacity growth. More specifically, we wanted to examine the possibilities of building demand for wood pellets through special marketing and financing programs to leverage the construction and operation of a new wood pellet facility.

We also designed the study to include research relating to residential and especially institutional sector understanding of wood pellet technology. Our intention was to use this research to identify the informational gaps in public understanding. We also designed the research in such a way as to educate certain target audiences on wood pellet technology.

A longer-term objective was to be of assistance to communities like

Missoula and Helena where the proliferation of wood stoves has made air pollution a major problem. Expanded wood pellet consumption and production would also create jobs in the currently depressed timber and wood products sector of the Montana economy.

2. Methodology and techniques used to conduct study.

Since this study has consisted of a number of different segments, different methodologies and techniques have been employed at different stages. The reader is encouraged to consult the various milestone reports for a more detailed description of the methodology employed for any particular segment of the project.

Milestone I sought to accomplish three tasks: 1) to assess the present level of public awareness (both among consumers and retail dealers) of the availability and effectiveness of pellet fuel; 2) to take stock of the current technological advances in making both pelletized fuel and devices for burning this fuel; and 3) to discover issues which might need to be addressed later in the study. Sharon Duckett performed this part of the study. The Missoula Wood Use Survey was analyzed in a preliminary way for information about levels of public awareness, and for changes in public attitudes. Retail dealers and stove and pellet manufacturers were interviewed, either by telephone or in person. All of the merchants questioned were asked what measures they felt were valuable in the promotion of pellet fuel burning.

Milestone II consisted of two parts. The first was an analysis of innovative financing and marketing strategies. This was undertaken by the

National Center for Appropriate Technology in Butte. They employed a national computer search, using several different reference services, and followed up with telephone calls to administrators and designers of the most promising programs.

The second part of Milestone II was an analysis of the costs of production and factors of raw materials supply. Sharon Duckett also conducted this part of the study. She made an inventory of currently generated mill residue to determine how much, if any, would be available to the pellet manufacturing industry, without competing with either the paper or particleboard industries for their traditional supplies. A telephone interview was conducted with mill managers, superintendents, or owners. They were asked for accurate amounts, or best estimates, of each mill's usual 24-hour mill residue output during normal production in each of four residue categories: wood fuel, sawdust, shavings, and hog fuel. We asked for the total amounts being generated, whether or not the residue was presently being sold in whole or in part, and if not sold, what was its disposition or use.

Ms. Duckett also studied production costs, both by interviewing pellet plant managers and by consulting resources available within the Department of Natural Resources and Conservation.

Milestone III was an analysis and projection of future wood pellet consumption in the greater Missoula area. It was conducted by Richard Steffel of Eco-Resource Systems of Missoula. Mr. Steffel accomplished the objective of this Milestone in three stages. He projected future numbers of pellet-burning devices, then projected pellet consumption per device, and finally described the forces likely to influence pellet burning in and around the Missoula area in the next few years. He drew heavily upon the Missoula Wood Use Survey and the MSU Wood Pellet study, as well as the sales records of Missoula Fireplace and Supply.

Milestone IV was an analysis of institutional sector markets. It was conducted by Daniel Kemmis. This part of the survey was confined to institutions within the three-county area that do not have ready access to natural gas, because pellets are not currently competitive with that fuel source. The Montana Local Government Energy Office was consulted for suggestions about which institutions to interview. Managers or maintenance personnel, or sometimes both, were contacted, and personal appointments were scheduled. Material about pellets was mailed to the interviewees, and the interviews were conducted on-site, so that the interviewer could tailor his questions to the particular circumstances of the specific institution.

RESULTS AND DISCUSSION

1. Current wood pellet market.

The wood pellet market has expanded dramatically in this area over the past seven or eight years. Consider, for example, two facts reported in Milestone I. Missoula Fireplace and Masonry Supply, the largest retail supplier of pellets in Missoula, reported that its sales of pellets had grown from 40 tons in its first year of operation, to 1,000 tons in its seventh year. Meanwhile, Bitterroot Timber Products of Darby, which manufactures but also distributes pellets, reported that over a three-year period, its volume had increased from 40 to 2,000 tons.

The study has consistently disclosed three reasons for this substantial increase in the demand for pellets. The first reason, which is valid for all types of wood burning, is simple economics: that against certain other forms of energy (especially fuel oil or electricity), wood is a cheaper form of fuel. The major shocks in energy prices in the 1970's have left a lasting residue of interest among consumers (whether residential, commercial, industrial, or institutional) in continuing to search out cheaper ways to heat buildings. Particularly among users who do not have ready access to natural gas, this factor continues to exert a steady market pressure in favor of wood.

Other factors, however, work against most forms of wood, but in fact increase the demand for pellets. One of these is the decreasing availability of suitable wood for burning obtainable by a trip to the woods. The second major factor, especially in the Missoula Valley, is air pollution. As air pollution has been more and more clearly attributed to wood smoke over the past few years, wood burning in the Missoula Valley has declined, both because of consumer concern over air quality, and because of the adoption of strict regulations that limit the days on which wood burning is permitted, unless one is using an approved, clean-burning device. Since pellet stoves qualify for burning at all times, these regulations have contributed substantially to the growing demand for pellets. The same is true of the increasing difficulty of finding suitable wood for burning within reasonable driving distance of most residences. Together, these two factors make pellets an increasingly attractive source of fuel, especially for those who are already inclined for market reasons to use wood as a major fuel source.

At the time of the Missoula Wood Use Survey (MWUS) (Spring of 1986), it was estimated that there were approximately 116 pellet-burning devices in use in the Missoula urban area, and another 74 in the outlying area. (See Milestone III.) Using the formulas developed in the wood pellet consumption analysis, this would indicate a 1986 consumption level of approximately 341 tons of pellets in the Missoula area. By 1987, as already stated, Missoula Fireplace alone was selling about 1,000 tons of pellets, and it was not the only supplier in the region. (See Milestone I.) While it is not possible to fix with any precision the exact number of tons of pellets currently being consumed in this area, it is safe to say that it is at least 1,000 tons per year, and the amount is growing steadily.

2. Results of market assessment.

Discussion. As originally proposed, the study would have included a formal survey of potential users to quantify the potential market for wood pellets in the region. As the study progressed, both the RC&D and the DNRC concluded that existing studies, if carefully analyzed and extrapolated from, could serve the same function at a much lower cost. In particular, the 1986 Missoula Wood Use Survey, and a Montana State University "Wood Pellet Study" (also conducted in 1986) were analyzed for this purpose. The results of this analysis are reported in Milestone III. In addition, this project included a survey of potential institutional-scale users, reported in Milestone IV. Because very few institutions have already converted to pellets, it is not possible to attempt a projection of use, in strictly quantitative terms, for this class of consumers, as was done for residential consumers, where the existing use and growth patterns are sufficiently established to permit of some extrapolation. Nevertheless, the survey of institutional-scale users did disclose some very useful information that will be discussed here, in conjunction with discussion of the projection of residential pellet demand.

The wood pellet consumption analysis analyzed the 1986 MSU and MWUS surveys to project pellet demand in this region through the winter of 1989-90. The conclusion of that analysis was that demand at that time can be conservatively predicted in the range of 1,300 to 1,700 tons per year of residential pellet demand. The emphasis here must be strongly placed on the word "conservative". As the Eco-Resources report in the wood pellet consumption analysis makes clear, the methodology employed was explicitly conservative. The report also points to several recent events, including regulatory changes, declining supplies of cord wood, and growing misgivings about catalytic stoves, which all make prediction uncertain, but which all at the same time contribute to what clearly seems to be a burgeoning demand for pellets. While it is certainly safest to err on the conservative side in these calculations, it is also worthwhile to note that growth may well be considerably in excess of what we have predicted. In fact, Missoula Fireplace is already reporting sales of about 1,000 tons per year, and it is only the leader among a number of pellet suppliers in the region. This may indicate that the number of pellet stoves is already in the range that the wood pellet consumption analysis predicts for 2 years from now, which in turn reinforces the conclusion that those predictions are quite conservative.

If we turn from the projection of residential demand to the institutional sector, both the uncertainty and the potential for growth increase substantially. There is now a several-year pattern of growth in the residential demand for pellets, which makes it possible (if still very difficult) to make some projections of future demand. With the institutional sector, this kind of baseline is essentially nonexistent. There are a number of plausible reasons for this lag. One, which is explored somewhat in Milestone I, is that there has not been as much development of pellet-burning devices for commercial- or institutional-scale users as there has been for residences. A fact encountered time and again in the course of this study is that pellet demand is very substantially a function of consumer awareness of and confidence in the equipment that will turn the pellets into heat. The analysis of institutional markets discusses a number of questions which institutional managers raised about the kinds of systems that they would have to install if they were to convert to pellets as a source of fuel. It is plausible to speculate that, on this score, the awareness and confidence level of larger-scale consumers has in fact lagged behind that of residential consumers.

There is a second, and possibly related difference between the two classes of consumers. While residential users are acutely aware of the economics of their energy bills, it is clear that their choice of fuels does not always rest solely on that basis. There are a number of other factors, from the annual trip to the woods to the exercise of splitting wood, to the crackle and cozy feel of a wood fire which also motivate families to use wood heat. Once they move in that direction, and then encounter the barriers of dwindling wood supplies or burning regulations, they are likely to go out of their way to preserve the wood option, by converting from cord wood to pellets. Institutional users are not nearly as subject to these non-monetary considerations. It makes sense for families to go to the woods, or to want exercise, or to sit around a crackling fire, but institutions do not do those things. This may help to explain why there are fewer institutional than residential pellet users at this point on the rising curve of pellet demand, but it does not lead to the conclusion that institutional users have no role to play in future expansion of pellet demand.

Because institutional energy decisions are more uniformly economic, it is to that quarter that we look almost exclusively to try to determine what role this sector might play in the future of pellet demand. Here, the first consideration is comparative energy costs. Because pellets are not currently competitive with natural gas, this portion of the study was restricted to those parts of the three-county area not serviced by natural gas. Within those areas, the interest in pellets is strong among institutional managers. There are a number of questions these decisionmakers would have to have answered, including questions about equipment, payback periods, and reliability of pellet supply. But our conclusion, in the analysis of institutional markets, was that there is a very definite and quite substantial potential for conversion to pellet use in this sector. One factor that stands out from our analysis bears emphasis here. For a number of reasons, it appears more likely that a number of institutions would convert more or less together to pellets, than that they would do it entirely independently of one another. This means that, if there were an increase in demand from this sector, it would likely be a rapid, rather than a steady, incremental increase. A second, related point is that these users, to an even greater extent than residential users, identify the reliability of supply as a major determinant in their decision as to whether to convert to pellets or not. This introduces a substantial "chicken-and-egg" factor into the situation. Potential producers want to know whether there will be demand or not, while potential consumers are asking whether or not there will be a reliable supply. This suggests the need for a higher level of contact and negotiation between potential producers and consumers than is often the case in a strictly market transaction. This factor will be discussed further in following sections.

One common feature of the market analysis of both the residential and institutional sectors had to do with the high front-end costs of conversion to wood pellets. For either family or institutional budgets, these high capital expenditures are a major deterrent to conversion. We anticipated this in designing the study, as we will discuss in the section on innovative financing and marketing strategies. The study itself strongly confirmed our original perceptions in this regard, and led even more strongly to the conclusion that further, major increases in pellet demand may rest upon the capacity of various groups and interests to collaborate upon common solutions to their energy problems.

3. Summary of market assessment regarding potential growth of wood pellet demand.

Based upon various factors, including the immediate past growth in pellet demand, interviews with suppliers and potential institutional users, and an analysis of the regulatory and technical areas, the prospects appear good for continued growth in pellet demand in this region. Residential demand alone should reach at least 1,500 to 2,000 tons per year within the next two years. Continued growth in demand depends, among other factors, upon the capacity of producers to reassure consumers about the reliability of supply, and upon the capacity of all concerned to address the problem of high up-front capital outlays for conversion to pellet use.

4. Potential innovative marketing and financing strategies.

In Milestone II, we undertook an analysis of various innovative financing and marketing mechanisms that might be used to overcome either or both of the chief factors inhibiting an expansion of the pellet market (high initial outlay for equipment and uncertainty of pellet supply). A number of the alternatives that were considered in that analysis showed some prospect of helping to address these factors. But in almost every case, new difficulties were uncovered, which in turn need to be addressed. Those difficulties sort themselves into a kind of pattern, which should be kept in mind by anyone attempting to follow up on this study.

For example, the possibility of a tie-in to the Low Income Energy

Assistance Program (LIEAP) was favorably assessed in the analysis of alternative financing mechanisms, but the question of long-term supply arose again in this context. That is, LIEAP administrators would not be willing to push for their clients to convert to pellet use unless they have some reason to believe that those clients would have a long-term, stable, and affordable supply of pellets. In this regard, low-income consumers are in the same position as other consumers in trying to decide whether or not to convert to pellet use. The upshot is that consumers have a stake in insuring a stable, affordable supply of pellets. This is precisely the situation in which consumer cooperatives have grown up in many industries. Since no single consumer can do anything about stabilizing the supply, while a number of consumers acting in concert could make a difference, our attention is directed toward the concept of a consumer cooperative. If the concept of bulk purchasing of pellet burning equipment were to have any feasibility, it would also seem to make most sense in the context of some form of consumer's cooperative that could jointly purchase pellets as well.

The analysis of alternative financing mechanisms also concluded that a revolving loan program, such as the one which Boise is instituting, seems to offer real potential. But Boise is an entitlement CDBG city, which gives them a source of discretionary funds that no entity in this part of Montana can command. Furthermore, Idaho had chosen (as Montana has not) to devote oil overcharge money to this kind of progressive program. Both of these factors lead to the conclusion that if Missoula or the surrounding region were to try to establish a revolving loan program, it would have to rely at least in part upon local capital to fund the program. It is difficult to see how such capital could be raised, except as part of a collaborative or cooperative venture, involving many segments of the local community.

The analysis of alternative financing mechanisms also found that individual feedstock collection would only be feasible if it were part of a larger strategy, such as a cooperative approach.

The concept of a municipal biomass program, along the lines of a Municipal Solar Utility was favorably assessed, but it was faced with two major drawbacks. First is the reduced availability of tax credits. Second is the question of whether or not monthly lease payments can be kept low enough to permit a positive cash flow to consumers from the outset. Again, this is the kind of situation to which consumer cooperatives have historically addressed themselves, because their prime objective is low cost to consumers (who are the owners) rather than a high profit margin. This factor may or may not be enough to salvage the concept of such a utility in the face of declining tax credits. In any event, it would be very helpful to determine whether some form of cooperative arrangement is feasible in this context.

The analysis of alternative financing mechanisms did examine briefly the concept of a cooperative approach, and found in effect that it would be worthy of a closer, more detailed examination. It pointed out that the apparent need for a cooperative approach exists both on the production and the consumption side of the ledger. We strongly recommend that if anyone in either the public or the private sector chooses to pursue the possibility of expanded pellet production in this area, that they consider the various financing and marketing options discussed in the analysis of alternative financing mechanisms, and that they devote some energy and resources to a further examination of various possibilities for cooperative approaches to this situation.

5. Feasibility of increasing pellet production.

This study has reinforced one basic conclusion about the feasibility of increasing pellet production in this region. Such an increase is a function of two mutually interrelated factors: the possibility of increasing demand, and the reliability and affordability of supply. The supply factor, in turn, depends upon the question of where the feedstock for pellet manufacture will come from. In the preceding paragraphs, we have discussed the demand side of this equation. We turn now to the supply side.

RESOURCE ASSESSMENT

1. Biomass resource availability in the area.

Milestone II addressed itself to a rough-cut assessment of the potential supply of feedstock for expanded pellet production in the Missoula area. We found that among larger sawmills operating in the greater Missoula area and in a number of surrounding counties, there is very little "uncommitted" mill residue that could be expected to become available at any time soon for pellet production.

Two major factors were taken into account in looking at the results of the assessment of mill residue available to a potential pellet mill that would be located near the greater Missoula market area:

1. An attempt to locate adequate supplies of raw materials not presently being consumed either by the existing pellet mill in Darby, or within the immediate area of that plant - or not presently being sold to the paper or particle board plants near Missoula, revealed the largest individual sources to be in Flathead and Lincoln Counties;
2. Locating a mill further than 50 miles from either the raw material sources or the marketplace significantly increases the cost of production and the ultimate cost of pellets to consumers. This cost is offset somewhat if large enough amounts of raw materials can be acquired at a single location reducing the number of trips required to obtain an adequate amount for daily use.

As stated above, the available residue, that is, that not presold or consumed by the sawmill generating it, is located primarily in Flathead and Lincoln Counties, as indicated below:

FLATHEAD - 100 units of chips daily

60 units of sawdust daily (bone dry - less than 2% moisture)

60 units of hog fuel daily

LINCOLN - 155 units of chips daily

137 units of sawdust daily (bone dry - less than 2% moisture)

There is an additional 77 units of hog fuel per day available in Missoula County, should the proposed pellet plant have a cost-effective use for that material.

Of this material, the best pellet feedstock would be the bone-dry sawdust. The 197 units of sawdust would furnish 236.4 tons of raw material for pellet making, daily. Using a conservative number of production days (239) annually, this would generate 28,250 tons of pellets. (The production days are calculated as follows: 5 days per week, 52 weeks per year, less 21 holidays or other non-production days.)

2. Other major factors necessary to development of wood pellet plant.

Among smaller sawmills, or those at a greater hauling distance from the pulp mill, there is a quantity of pellet-quality residue available. These sawmills are in some ways in a position like that of the consumers we mentioned earlier. They have a stake in pellet production, yet none of them operate on a scale that would enable them to do anything about the situation on an individual basis. Again, the question is whether a cooperative approach would enable these separate operators to capture some economies of scale not available to any of them separately.

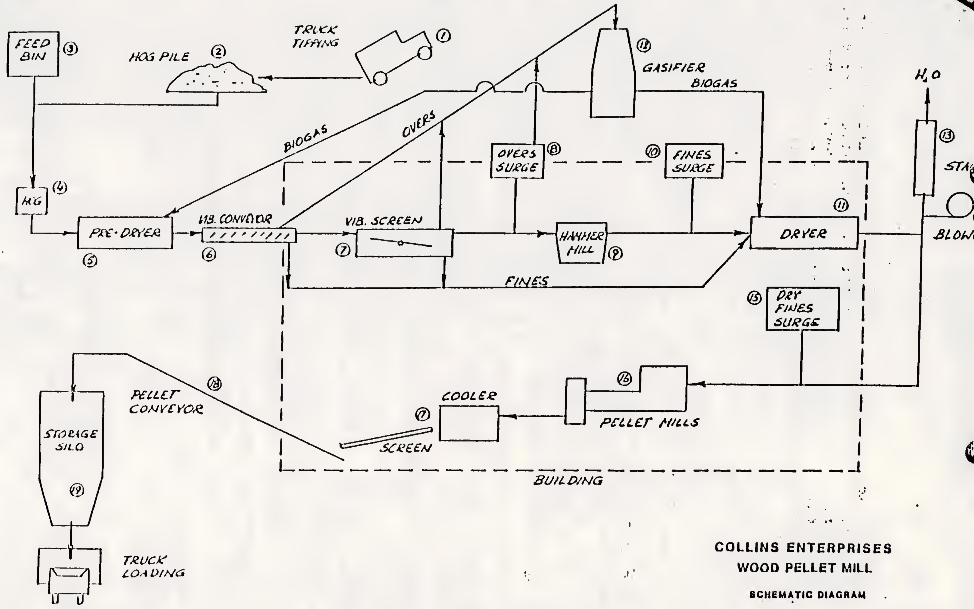
3. Summary of resources available.

Primarily because of the presence of other mill-residue users in the immediate Missoula vicinity, large quantities of pellet feedstock are not available from any single source, without travelling further from Missoula than may be economically feasible. Smaller sources of feedstock are available within shorter distances, but the coordination of these sources would require a substantial amount of cooperation and collaboration among the suppliers, and between them and the pellet producer. A formal cooperative structure may be the best way to solve this problem, with the small sawmills forming a suppliers' cooperative.

ECONOMIC ANALYSIS

1. General plant design and layout.

As we stated in the grant application, the technology for converting wood wastes to pellets is well-known. There are about 20 wood pellet plants operating in the United States and pelletization equipment is readily available from commercial suppliers. Most pelletized wood facilities follow a fairly standard overall system design. This design is presented schematically on the following page. In this study, we have not aimed to devise any innovations in pelletized wood production engineering or facility design. Consequently, a more detailed description of a production facility design has not been provided.



COLLINS ENTERPRISES
WOOD PELLET MILL

SCHEMATIC DIAGRAM

2. General assumptions, level of production capacity, and economic parameters used in performing economic assessment.

We conducted our economic analysis, assuming the availability of the 28,250 tons per year found to be reliably available in the resource assessment. Using the top-end price per ton of $80 for a ton of unbagged pellets, the pellets would sell for $2,260,000. Based upon comparative figures obtained from other pellet mills in the region, and from data available from DNRC, we calculated a price-per-ton manufacturing cost for a mill of this level of production at $42 per ton, unbagged, and F.O.B. pellet plant. The annual cost of producing the pellets, then, would be $1,186,500. To this must be added equipment replacement and maintenance costs, which, based upon comparative figures, we calculated at $4.42 per ton, or $124,865 per year. Finally, we calculated costs of transportation of pellets from plant to market at $.107 per ton/mile. If the average distance were 50 miles from the plant, this would add another $151,048. In summary, then, the 28,250 tons of pellets would sell for $2,260,000, and they would cost roughly $1,462,000 to produce and ship, leaving a profit figure of just under $800,000. Allowing for debt repayment and taxes, a plant doing this volume of trade could support an initial investment of slightly over $3 million, with a ten-year repayment period and an interest rate of 10%. This amount of capital investment would purchase a pellet production plant with two pellet-making machines, capable of producing the 28,250 tons annually.

These calculations assume that pellets are sold unbagged. Bagging adds another $20 per ton to the production cost, but local markets indicate that this cost is fully recoverable. That is, bagged pellets regularly sell for

$100 per ton, as against the $80 per ton which we calculated for unbagged pellets.

3. Summary of results of economic analysis.

Essentially, our economic analysis was supply-driven, in that it started with the figure of 28,250 annual tons that the resource assessment had provided. Clearly there is not, however, at the present time, a local market for this level of production. A plant of this scale would only be feasible if the local residential market continued to expand steadily (as it has been doing for several years), and if there were also substantial expansion both into the commercial and institutional sector and to outlying areas, possibly including much of northwestern Montana.

Another approach would be to plan that for the next several years, growth in the local market would be matched by growth in production at the Darby plant, until that plant reaches its capacity or begins to lose competitiveness (especially beyond Missoula) because of transportation costs. At that time (or in the meantime) it may be worthwhile for another producer to consider a smaller-scale plant than the one analyzed here, matching its level of production, at least initially, to the immediately foreseeable local market and to the locally available resources. (In the course of doing this study, we have been contacted by a large number of small sawmill operators, inquiring about the study, and speculating about whether or not they might be able to start a small pellet plant as an adjunct to their mills. In addition, we have been contacted by some independent entrepreneurs who are interested in starting a smaller-scale plant geared to the local market and source of supply.)

GRANT ADMINISTRATION

1. Work Schedule.

The original agreement called for completion of the final report by July 1, 1987. Several factors account for the additional six months that have been required to complete the project. The most important of these was that, in the course of the study, new data or perspectives several times dictated a change in the approach of the study. Specifically, the study had initially been designed substantially around the concept of conducting a major marketing survey, but as the study progressed, both the RC&D and the DNRC concluded that existing studies could be analyzed to obtain much the same data, at a considerably lower cost. Changes in the work plan, however, took several months to finalize. This was compounded by the fact that, following completion of the analysis of alternative financing mechanisms, the RC&D concluded that the possibility of a cooperative approach to pellet production should be explored in more depth. We spent several months discussing this possibility with DNRC. The Department finally concluded that such an analysis was a good idea, but that it was not within the scope of the original agreement, and therefore could not be added to the work plan. Because these discussions had taken several months, the DNRC extended the project schedule accordingly.

Even then, the work has not progressed as steadily as might have been hoped for. This is due in part to a change in the operation of the RC&D between the beginning and the end of the project. When this grant was applied for, the RC&D was also administering another grant from the United States Economic Development Administration. (It was under the auspices of that grant that the RC&D had worked with all three counties on the pellet situation initially, and had applied for this grant.) The EDA grant ended in October 1986, and was not renewed, which left the RC&D without a full-time economic development staff person to administer this grant. We have therefore been left to administer the grant on a part-time, consulting basis, which has meant that it has to be conformed to other work schedules in a less-than-optimal way.

2. Budget.

(The following figures include Milestone V.)

Category	Grant Funds	In-kind
a) Salaries	$ 0.00	$ 113.20
b) Fringe Benefits	0.00	0.00
c) Contracted Services	9,156.00	5,810.48
d) Supplies & Materials	150.62	110.60
e) Communications	432.16	0.00
f) Travel	172.61	7.00
g) Rent & Utilities	90.00	0.00
h) Equipment	18.00	1,800.00
TOTAL	$10,019.39	$7,841.28

3. Technology transfer activities summary.

In the course of the survey, we have been asked by a number of people, from government agencies to retailers, producers, potential producers, sawmill operators, etc. for copies of the final report. We will provide this report to that list, along with information about how to contact the Department for more information. In addition, all of the interviewees in the analysis of institutional markets received the information packet outlined in that Milestone.

RESULTS AND CONCLUSIONS

1. Summary of major findings and recommendations.

We will begin our summary with the demand side of the study. We undertook the study in large part because we thought that the Missoula Valley, with its air pollution problems, should be a potentially expanding market for wood pellets. Both our interviews with dealers and our analysis of existing surveys have confirmed this perception. The market is expanding steadily and quite robustly, and a number of factors point toward continued expansion. The major limitations upon that market growth are consumer uncertainty about the source of supply, and economic considerations, especially about the high initial capital outlay. A program that would address these concerns would expand substantially the growth in a market that is already expanding very quickly.

The institutional sector presents a somewhat different, but equally challenging and promising picture. Here, the main emphasis has to be on those institutions not readily served by natural gas. Within those areas, the interest in pellets is high, and the attitude is generally positive. There is substantial room for public education to inform institutional managers about pellets. Again, as with residential consumers, concern about reliability of supply and about large up-front capital outlays are major deterrents to conversion to wood pellets. With both classes of consumers, the possibility of a consumer cooperative, with provisions for a revolving loan fund to soften the impact of the capital expenditure, is well worth exploring. Local governments should be considered as major potential consumers (especially in the non-natural gas areas), and should be included in the planning and perhaps the operation of any innovative financing or marketing program.

Moving from the demand to the supply side, the picture is immediately complicated by the fact that other wood products industries in the Missoula area consume a large percentage of what would otherwise be locally available feedstock for a pellet plant. This means either that feedstock would have to be obtained from as far away as Flathead and Lincoln Counties, or that small sawmills closer to Missoula, which do not ship their waste to the pulp or particleboard plants, would have to be induced to participate in a pellet-making operation. Again, a cooperative approach (modeled on other supplier cooperatives) should be further explored.

While this study was not designed to make site-specific plant establishment recommendations, there are several factors that would focus attention on the general area of Mineral and Sanders Counties. A number of the smaller sawmills lie in that direction, and those two counties lie generally between Missoula (the major market) and Lincoln and Flathead Counties (the major sources of supply). In addition, Mineral, Sanders, and Lincoln Counties are generally without natural gas, which means that major increases in institutional and commercial demand for pellets would be expected in that direction, if it is to occur at all. Because transportation costs, both of raw material, and of pellets, are a major factor in the economic analysis, it would seem to make sense to consider the siting of any new pellet plant in a location both near Missoula, near major sources of uncommitted supply, and near major growth centers of larger-scale, non-residential demand.

2. Additional work needed to encourage growth in wood pellet market.

Our major recommendation for additional work is the same as it was during the course of the study: that research be conducted into the various possibilities of combining innovative financing and marketing strategies with different cooperative approaches to wood pellet production and distribution, as well as the sale of pellet-burning equipment.

We also recommend that various programs (such as Oregon's and Boise's) to use different sources of public money for revolving loan programs be carefully monitored, and that Montana and any appropriate local governments be prepared to launch similar programs if the opportunity arises.

We recommend that local governments, or local economic development corporations, or both together (perhaps with assistance from the Montana Departments of Natural Resources and Conservation and of Commerce) sponsor some roundtable discussions, inviting pellet suppliers, pellet stove manufacturers, small sawmill owners, wood burning consumer groups, and existing and potential pellet producers, to consider ways of following up on the recommendations of this study. Most of the recommendations require different groups and interests to work together. In general, someone in a credible or authoritative position is required to launch and mediate the discussions that could lead to such cooperation. We strongly recommend that local governments in this region take the lead in launching this process.